

**MA219: Linear Algebra**  
(2022 Autumn Semester)

**Place & Time:** Maths Dept., Tue Thu 10–11:30 AM (Credits 3:1)

**Instructor:** Apoorva Khare  
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**Office:** Mathematics, X26  
**Office Hours:** Wednesday 1:15–3:15 PM  
**Microsoft Team:** MA219 - IISc Math - Fall 2022

**Teaching Assistant, email, office, office hours**  
Vijaya Kumar U. vijayak@iisc.ac.in Room N13 Thu 3:30–5:30 PM

**Course website:** <http://www.math.iisc.ac.in/~khare/teaching.html#2022-219>

**Pre-requisites for Undergraduates:** UM102

**Syllabus:**

- Vector spaces: definition, basis and dimension, direct sums.
- Linear transformations: definition, rank-nullity theorem, algebra of linear transformations, dual spaces, matrices.
- Systems of linear equations: elementary theory of determinants, Cramer’s rule.
- Eigenvalues and eigenvectors, the characteristic polynomial, the Cayley–Hamilton theorem, the minimal polynomial, algebraic and geometric multiplicities, diagonalization, Jordan canonical form.
- Symmetry: group of motions of the plane, discrete groups of motion, finite groups of  $SO(3)$ .
- Bilinear forms: Symmetric, skew symmetric and Hermitian forms, Sylvester’s law of inertia, Spectral theorem for the Hermitian and normal operators on finite-dimensional vector spaces.

**Suggested books and references:**

- (1) Hoffman, K. and Kunze, R. *Linear Algebra*, Prentice-Hall India, 1992.
- (2) Artin, M. *Algebra*, Prentice-Hall India, 1994.
- (3) Halmos, P., *Finite dimensional vector spaces*, Springer, 1987.

**Grading & Exam Schedule** (Credits 3:1)

Homework+Quizzes	25%	due by Thursday in TA office hours, or earlier in class
Mid-sem	25%	September 20, Tuesday, 10 – 11:30 AM in class (Office hours that week: Sep 19, Monday, 1–3 PM)
Final	50%	December 8, Thursday, 9 AM – 12 PM, in class

**Homework:**

Homework will be assigned weekly – posted on the course webpage – and is due by Thursday in the following week in the TA office hours, or earlier in class. Each student should hand in their **independently written** solutions, written in their own words.

**Miscellaneous**

- (1) **Exams:** There will be no backup exams, so please be on campus and available for the mid-sem and the final.
- (2) **Emails:** Please write MA219 in the subject heading of all email correspondence with the instructor/TAs. This is in general effective in filtering / weeding out spam email.
- (3) **Homework:** The TAs are responsible for the homework component of the class. We are unable to accept late homework. Homework extensions only delay the grading of solutions. Please submit HW on time, in the TA office hours on Thursday or in class. Do not place your homework under the office doors of the TA/instructor. In the past, homework placed under office doors has sometimes been lost or misplaced.
- (4) **Office Hours:** Please note that it is difficult to discuss mathematics questions by email due to the lack of an appropriate interface. You are encouraged to ask your technical questions during office hours. As the TAs have responsibilities other than this course, please go to them only during office hours (unless prior arrangements have been made).
- (5) **Ethics:** Read the information on the IISc student ethics page.